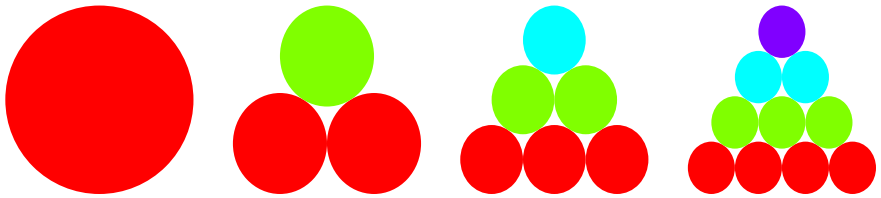
Lecture 1: Worksheet

In this first lecture, we want to see that the **essence** of calculus is already in **basic arithmetic**.

Triangular numbers

We stack disks onto each other building n layers and count the number of discs. The number sequence we get are called **triangular numbers**.

1	3	6	10	15	21	36	45	...



n=1 n=2 n=3 n=4

This sequence defines a **function** on the natural numbers. For example, $f(4) = 10$.

1 Can you find $f(100)$? The task to find this number was given to Carl Friedrich Gauss in elementary school. The 7 year old came up quickly with an answer. How?

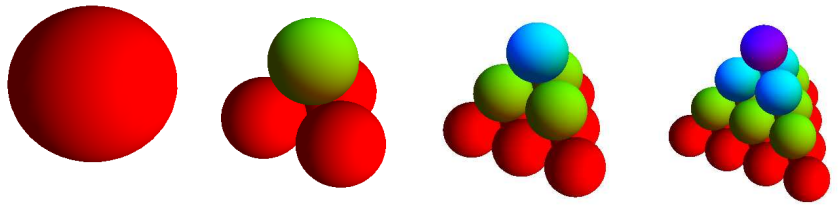
Carl-Friedrich Gauss, 1777-1855

Tetrahedral numbers

We stack spheres onto each other building n layers and count the number of spheres. The number sequence we get are called **tetrahedral numbers**.

1	4	10	20	35	56	84	120	...

Also this sequence defines a **function**. For example, $g(3) = 10$. But what is $g(100)$? Can we find a formula for $g(n)$?



n=1 n=2 n=3 n=4

2 Once you know the formula for $g(n)$ given to you as $g(n) = n(n+1)(n+2)/6$, verify that it is the right one, by checking $g(n) - g(n-1) = n(n+1)/2$.